

9.0 Cost Analysis

9.1 Capital Costs

9.1.1 Capital Costs of Project Alternatives

There are a number of factors that were included in developing a preliminary estimate of costs for the alternatives evaluated in this Draft Environmental Impact Statement (EIS). These include estimates for:

- **Construction:** includes preliminary estimates for mobilization, removals, excavation, materials (i.e., pavement, aggregate), traffic control/signing and striping, storm sewer and drainage, turf establishment and erosion control, bridges, culverts, retaining walls, noise walls, lighting, and traffic signals, and other miscellaneous construction costs. Also includes 12 percent for professional services necessary to complete construction. Construction costs were inflated to 2015 dollars to reflect anticipated year of construction.
- **Right-of-Way/Land/Mitigation:** includes estimated right-of-way acquisition (permanent; greater than 99 years), relocation costs, air quality mitigation, mine operating expenses, mineral rights, and other compensation

Estimates for unit costs were reviewed and evaluated based on identified risks for cost variation, and a Monte Carlo simulation¹ was used to develop estimated cost ranges for each alternative based on these risks. Specific unit costs for ferrous and non-ferrous resources were not available at the time of this estimate and therefore were not specifically included; however, the cost ranges were set to cover a range of risks associated with these and other unknown costs and/or variability in cost factors. Preliminary cost ranges for each of the alternatives, separated into the construction and right-of-way/land/mitigation cost categories described above, are provided in **Table 9.1-1**. The ranges shown are for the purpose of comparing alternatives at an order-of-magnitude level and are based on concept-level footprints and information available at the time of Draft EIS preparation. Additional cost factors, such as operation and maintenance costs, have not been included in these estimates at this time.

Refined cost information for the preferred alternative will be report in the Final EIS, as available. The ferrous and non-ferrous resource valuations are underway and will be used in right-of-way negotiations. This analysis will estimate value based on the amount and quality (level of oxidation) of ferrous resources present, as well as its accessibility/location. Samples are being evaluated for indicators of ferrous and non-ferrous resources and potential for these resources within the areas of evaluation for each alternative.

Table 9.1-1. Range of Total Capital Costs for Construction^A

Alternative	Construction Cost	Right-of-Way/Land/ Mitigation Cost	Total Capital Costs for Construction
No Build Alternative	\$1-2 million	\$0	\$1-2 million
Existing US 53 Alternative	\$0	\$400-600 million	\$400-600 million
Alternative M-1	\$235-350 million	\$80-100 million	\$315-450 million
Alternative E-1A RSS Option ^B	\$185-280 million	\$10-20 million	\$195-300 million
Alternative E-1A Bridge Option	\$165-250	\$10-20 million	\$175-270 million
Alternative E-2 Straight Option	\$165-215 million	\$15-25 million	\$180-240 million
Alternative E-2 Curved Setback Option	\$165-215 million	\$15-25 million	\$180-240 million

^A Based on 2014 dollars; construction costs inflated to 2015 dollars. Does not include costs for maintenance/operation.

^B Future mine access bridge anticipated to add approximately \$12 million to the cost of the Alternative E-1A RSS Option (2015 dollars).

¹ Monte Carlo simulation is a computerized mathematical technique that allows for risk in quantitative analysis and decision making to be taken into account. It furnishes the decision-maker with a range of possible outcomes and the probabilities they will occur for any choice of action.

The descriptions of the alternatives below are provided to illustrate the assumed components for project alternatives as the basis for project cost estimates. Changes to the design assumptions may occur as more information becomes known and as higher levels of engineering design are undertaken.

9.1.1.1 No Build Alternative (Easement Agreement Area Closed)

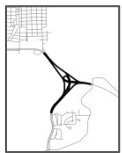


The No Build Alternative would respond to the easement terms by closing the existing easement agreement area of US 53, resulting in traffic being rerouted to existing highways. Signage would be used to officially mark the rerouting of US 53, which would follow existing MN 37, Co. 7, and US 169. The No Build Alternative entails the removal work necessary to meet the US 53 roadway abandonment requirements, along with signage necessary to maintain connections between MN 135 and US 53 south of the mine property and between Virginia's 2nd Avenue and US 53 north of the mining property.

More specifically, the No Build Alternative estimate includes the following layout assumptions:

- Removal of all US 53 roadway surfacing and bridge structures within the existing easement agreement area property except for a portion of northbound US 53 south of MN 135 which would be utilized for the US 53/MN 135 connection

9.1.1.2 Existing US 53 Alternative (Easement Agreement Area Remains Open)



The Existing US 53 Alternative seeks to maintain the existing US 53 corridor location, requiring the payment of mineral rights to the landowner, RGGS. Compensation to the mine would also be possible to mitigate the loss of tax revenue from the mine's inability to expand.

9.1.1.3 Alternative M-1



Alternative M-1 would construct an embankment through the operating mine and utilize bridge structures at both the southern and northern ends of the mine crossing. The bridges would carry US 53 over the active mine pit, thereby providing opportunity for mining haul/transportation activities to cross beneath the roadway in a somewhat circular fashion. Embankment construction estimates through the mine area include costs for dynamic compaction at the existing surface level and the use of engineered fill slopes within the new embankments. The dynamic compaction would be utilized in an effort to consolidate the upper layer of the previously placed fills, and the engineered slopes allow for steeper side slopes on the new embankment, which allows for a reduced footprint within the mine. The potential effects of mine production blasting have been considered and may affect design of the embankment.

The Alternative M-1 estimate includes the following general layout assumptions:

- US 53 reconstruction length of approximately 21,250 feet
- MN 135 access/connection is perpetuated through an at-grade signalized intersection
- 2nd Avenue access is provided via a reconstructed segment of US 53 northbound, abandoned as a result of the realignment. Connection to US 53 is provided via an at-grade signalized intersection.
- South bridge: three span, 670-foot long steel plate girder bridge. Center span to provide 120-foot vertical clearance for mine drill rig crossing. Center span also accommodates minimum 135-foot wide by 65-foot vertical opening to allow for mine haul truck crossing.
- North bridge: three span, 395-foot long steel plate girder bridge. Center span accommodates minimum 135-foot wide by 65-foot vertical opening to allow for mine haul truck crossing.
- Both bridges will be constructed in regions where mine fills have been placed. Due to settlement concerns, foundation piling estimates assume piling will need to penetrate through the fills and terminate at bedrock depth.

- Embankment construction through the mine assumes:
 - In-place surface will be dynamically compacted prior to constructing embankments to attempt to control embankment settlement
 - New embankment (primarily between the two bridges) will be constructed as an engineered fill slope with 1:1 (vertical to horizontal) side slopes. Unreinforced fill will then be placed outside the 1:1 core to create a final embankment slope of 1:2. This additional side slope fill could provide protection to the reinforced core in instances of flyrock from mine blasting or other mine activities.

The cost range in **Table 9.1-1** includes the potential business risk mitigation cost range. As described in Section 4.2.4.2, in an effort to minimize risk to mine operations due to air quality concerns, the Minnesota Department of Transportation (MnDOT) investigated the potential to provide a physical barrier over the roadway for this alignment to prevent user exposure to potential PM₁₀ exceedances from mine dust. This analysis is documented in two technical memorandums which can be reviewed on the project website.² These memorandums include the Highway 53 M-1 Alignment Air Quality Mitigation Memo (CH2M Hill, 2013) and Structural Cost Estimate for Elevated Tunnel for US 53 Alternative M-1 Air Quality Mitigation (Kimley-Horn, 2013). Two tunnel options were considered, including construction of a three-sided concrete cover that in effect creates an elevated tunnel that US 53 would travel through. Option 1 spanned the full permit to mine limits (6,100 feet) to avoid any exposure within the permit area and to minimize the air handling equipment necessary. Option 2 shortened the length of tunnel to extend just beyond the potential exceedance area (3,000 feet) with air filtration to treat potential dust levels at the portals. The combined structure and air handling (including fire safety) equipment result in a cost range of \$65 million to \$130 million of construction costs for Alternative M-1, in addition to the roadway and right-of-way cost, pushing project costs well beyond current funding (Section 9.3).

9.1.1.4 Alternative E-1A



Alternative E-1A routes to the east, avoiding the active UTAC mine; however, it would require construction within the Rouchleau Pit. Crossing of the pit would be accomplished by building on an existing submerged haul road embankment with an RSS fill or a bridge.

The Alternative E-1A estimate includes the following layout assumptions:

- US 53 reconstruction length of approximately 24,600 feet
- Intersection Option: MN 135 access/connection is perpetuated through an at-grade, signalized intersection
- Interchange Option: The additional cost to construct an interchange at MN 135/US 53 is estimated to be \$4 million, excluding any additional right-of-way that may be needed. This estimate includes a compressed diamond configuration with one bridge, full access ramps, and a 25 percent contingency.
- Access to 2nd Avenue is provided via an at-grade, signalized intersection
- RSS Option: 2,800-foot long engineered fill slope to be constructed in drawdown, or wet condition (several options are being considered)
- Bridge Option: 2,800-foot long bridge to be constructed across the pit. Costs for the Bridge Option are listed separately.

In the future (estimated to be 30 years), construction of a mine access bridge on the east side of the pit to allow future mining access to the permit to mine area east of the new road alignment may be required. Cost estimates do not include construction of this future mine access bridge, which would add an estimated \$12 million (2015 dollars) in cost to this alternative.

² <http://www.dot.state.mn.us/d1/projects/hwy53relocation/TechnicalReports.html>

Separate cost estimates were also developed for two dewatering methods for the RSS Option, which include two of three of the dewatering routes evaluated. The first includes the option to transfer water from the initial drawdown of the Rouchleau Pit to the West Two Rivers Reservoir and discharge the maintenance dewatering system to the Enterprise Pit and Sauntry Creek. The second includes the option to transfer water from the initial drawdown of the Rouchleau Pit to Minntac Tailings Basin Cell 2, with maintenance dewatering discharged to the Enterprise Pit and Sauntry Creek.

Cost estimates for both options include the set-up of two separate temporary pumping stations, pump rental, suction and discharge pipe rental, and diesel fuel costs. Mobilization for each option was estimated at four percent of construction costs. An additional 15 percent contingency was included in the preliminary design estimate to cover undeveloped design details. Costs for pump and pipeline monitoring for the duration of the dewatering operation were not included. It was assumed that the monitoring would be done by MnDOT staff.

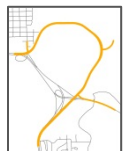
■ **West Two Rivers Reservoir/Enterprise Pit**

A preliminary opinion of probable costs for this option totals \$13.7 million. Under this option, seven 4,500 gallons per minute (GPM) drawdown pumps (six operating and one spare) and three 4,500 GPM pumps (two operating and one spare) were included in the estimate. After the initial three-month drawdown period, the drawdown pumps would be taken out of service. A detailed breakdown of the costs is included in the TH 53 Relocation Alternative E-1A RSS Construction Option Water Management Study (HDR, 2014; provided in [Appendix G](#)).

■ **Minntac Tailings Basin Cell 2/Enterprise Pit**

A preliminary opinion of probable costs for this option totals \$21.6 million. This option includes the installation of seven drawdown pumps (six operating and one spare), six booster pumps (all operating), and three maintenance pumps (two operating and one spare). A detailed breakdown of the costs is included in the TH 53 Relocation Alternative E-1A RSS Construction Option Water Management Study (HDR, 2014; provided in [Appendix G](#)).

9.1.1.5 Alternative E-2



Alternative E-2 routes to the east, avoiding the active UTAC mine boundary; however, it would require construction through the Rouchleau Pit. The Rouchleau Pit crossing is accommodated by a bridge structure. The bridge structure would cross between the east and west sides of the pit with abutments built high atop the presumed bedrock ridges at each side. For intermediate support within the 1,350-foot bridge length, three tall support piers ranging in height from 200 to 250 feet would extend down to pile supported foundations built at approximately the existing water level elevation.

The Alternative E-2 estimate includes the following layout assumptions for both the Straight Option and the Curved Setback Option:

- US 53 reconstruction length of approximately 20,500 feet
- Intersection Option: MN 135 access/connection is perpetuated through an at-grade, signalized intersection
- Interchange Option: The additional cost to construct an interchange at MN 135/US 53 is estimated to be \$4 million, excluding any additional right-of-way that may be needed. This estimate includes a compressed diamond configuration with one bridge, full access ramps, and a 25 percent contingency. The location of this interchange requires substantially more earthwork than under the Intersection Option.
- Access to 2nd Avenue is provided via an at-grade, signalized intersection
- Single, four span, 1,350-foot long steel plate girder bridge
 - Bridge crosses over the existing Rouchleau Pit

- Extent of mined fill placed over bedrock within the pit is unknown. For determination of foundation piling lengths, estimate assumes a bedrock elevation at approximately 1,200 feet.

9.2 Benefit-Cost

As required by the State of Minnesota, a benefit-cost analysis is prepared for any trunk highway construction project greater than \$10 million (Laws of Minnesota 2001, chapter 10, article 2, section 41). The proposed Build Alternatives for this project have been estimated to cost more than \$10 million, and the benefit-cost analysis for the project is based on determining the present value of all benefits and costs associated with each of the Build Alternatives compared to the No Build Alternative.

The purpose of a benefit-cost analysis is to express the effects of an investment (or closure) into a common measure (dollars). This allows for the fact that the benefits or costs of a project are often accrued over a long period of time, while the initial investment is incurred during the initial years of the project.

In this analysis approach, any quantified benefits that are greater than or equal to the quantified costs (benefit-to-cost ratio greater than one) represents an economically viable project.

9.2.1 Methodology and Assumptions

The monetary benefit for the project is quantified in terms of reduced vehicle miles traveled (VMT), vehicle hours traveled (VHT), and estimated crashes over the analysis period between the No Build Alternative and the Build Alternatives. The costs typically include construction, bridges and structures, right-of-way, and engineering/project delivery costs. Remaining capital values of these roadway features at the end of the analysis period are subtracted from the total cost of the project.

The results of the analysis provide input for evaluating the overall benefit of the proposed improvements to the corridor. Due to the planning level of detail in the calculations, the magnitude of the benefit-to-cost ratio is not as important as the value being greater or less than one.

9.2.1.1 General Assumptions

- All monetary values were discounted to the 2014 analysis year. Inflation was not included.
- The 20-year benefit period was based on a 2017 day-of-opening (or closure) through 2037
 - The No Build Alternative included a change between 2023 and 2024. At that time, Co. 101 was assumed closed, changing traffic routing patterns through the year 2037.
- Yearly Build and No Build benefits were calculated based on linear interpolation over the 20-year analysis period
 - The No Build Alternative assumed two linear interpolations, one from 2017 to 2023, then from 2024 to 2037
- The number of days per year used in the analysis was 365.25. This is based on the roadway closure and rerouting affecting all traffic every day of the year.
- Longer travel times and rerouting of trips during construction years were not included
- Preliminary costs estimates were completed using MnDOT methodology. The cost estimates were based on documented construction costs. The cost estimates included all roadway sections including local street connections due to access changes.
- Estimated costs for right-of-way and mineral rights were included in the total capital cost for construction (see [Table 9.1-1](#))

- Operating and maintenance (O&M) values were estimated based on MnDOT guidance from both the Office of Capital Programs and Performance Measures and District 1 staff
 - The No Build and Build Alternatives have very similar roadway networks that would incur the same O&M costs. Therefore, only the change in roadway length was used in the calculations. Since the No Build Alternative removes roadway, it had a baseline value of 0.
 - Yearly bridge inspection and maintenance estimated at \$0.35 per square foot (value provided by MnDOT)
 - Roadway improvements possibly needed due to the increased traffic demands on existing routes in the No Build Alternative were not considered at this time
- Yearly intersection crashes and crash benefits were calculated for all alternatives. A crash history was obtained from the Traffic Analysis Technical Report (CH2M Hill, 2013) that included crashes along all roadway segments between 2007 and 2011.
- VMT and VHT values used were based on data provided in the Highway 53 Relocation Economic Impact Study (McComb Group and SEH, 2014)

Table 9.1-2. Benefit-Cost Results

Alternative	Benefit-Cost Ratio
No Build Alternative	0
Existing US 53 Alternative	4.8
Alternative M-1	2.8
Alternative E-1A RSS Option	4.2
Alternative E-1A Bridge Option	5.0
Alternative E-2	5.8

Preliminary analysis indicates that all of the Build Alternatives have a benefit-cost ratio greater than 1.0, meaning the VMT, VHT, and crash reduction benefits of the project are estimated to be greater than the costs associated with the construction of the project.

Alternative E-2 has the highest ratio at 5.8; the Alternative E-1A Bridge Option has the second highest ratio at 5.0. The Existing US 53 Alternative and the Alternative E-1A RSS Option both are above 4.0 with ratios of 4.8 and 4.2, respectively.

At this level of analysis, the magnitude of the benefit-cost ratio is not as important as the overall finding that the ratio is greater than one. Further refinements to the VMT and VHT values are possible using different traffic models and methods. However, this basic analysis indicates that the Existing US 53 Alternative and all of the Build Alternatives are economically valuable.

9.3 Project Delivery Method

MnDOT is using the Construction Manager/General Contractor (CMGC) project delivery method for roadway construction for this project. This is one of four general project delivery methods: design-bid-build,³ design-build,⁴ public-private partnership,⁵ and CMGC.

³ Design-bid-build is a traditional and well-known method of project delivery. It splits the design and construction activities of a particular project, with potentially separate entities completing the work under separate contracts. Activities occur in a sequential manner (i.e., preliminary design is completed before final design begins), and all design is completed prior to beginning construction. This often takes a longer time to complete than design-build but is thought to offer a more competitive bidding and offers the owner significant control over the end product.

⁴ Design-build is a method of project delivery in which one design-build team works under a single contract with the project owner to provide design and construction services. The owner has a single point of contact with the team and does not have to be involved in management of multiple firms. Activities overlap, and construction begins before final design is complete. This can save time in the schedule and allow for more collaboration between design and construction but also may introduce additional risks.

CMGC project delivery allows an owner (MnDOT) to engage a construction manager during the design process to provide constructability input. The CMGC contracting method offers benefits to MnDOT in terms of innovation, value, and speed.

The CMGC construction manager is generally selected on the basis of qualifications, past experience, or best value. During the design phase, the construction manager provides input regarding scheduling, pricing, phasing, and other factors that helps the owner design a more constructible project. At approximately an average of 60 percent to 90 percent design completion, the owner and the construction manager negotiate a “guaranteed maximum price” for the construction of the project based on the defined scope and schedule. If this price is within 10 percent of an independent estimate, a contract is executed for construction services, and the construction manager becomes the general contractor.⁶ If the price is not within 10 percent, MnDOT prepares a variance report and tries to reconcile differences in pricing assumptions for items of work that differ by more than 10 percent. If reconciliation is possible, changes to the cost model and baseline schedule are made. If reconciliation is not possible, the CMGC contract could be terminated and the project procured through another method, or management could be consulted on the option to award the contract.

Although the CMGC construction manager’s scope of work includes providing technical assistance during the NEPA process, the construction manager does not have any role in the preparation of NEPA documentation or any decision-making responsibility with respect to the NEPA process. The CMGC contract includes appropriate provisions ensuring that no commitments are made to any alternative being evaluated in the NEPA process and that the comparative merits of all alternatives presented in the NEPA document, including the No Build Alternative, are evaluated and fairly considered. The CMGC contract includes appropriate provisions ensuring that all environmental and mitigation measures identified in the NEPA document are implemented.

MnDOT has been moving forward with preliminary design plans for the Build Alternatives concurrent with preparation and public release of the Draft EIS in an effort to better define the design details, right-of-way needs, etc., to inform the selection of a preferred alternative and help to minimize schedule delays given the time constraint the project is under to vacate the existing easement agreement area.

MnDOT will use a “green sheet” tracking system to document and manage all environmental and design commitments made for the US 53 project through the EIS and permit review process. The green sheet will be developed for the preferred alternative and included in the Final EIS.

9.4 Available Funding

9.4.1 Estimate of Cost

The estimated total project cost of the preferred alternative (in 2015 dollars) is \$180 to \$240 million.

9.4.2 Anticipated Funding

The funds allocated for the proposed project (SP 6918-80 and associated projects) are a combination of federal and state funds.

- Federal: \$30 million (National Highway Performance Program – NHPP)
- State Trunk Highway Bonds: \$34 million (Chapter 152)

MnDOT currently has \$30 million in federal funds and \$34 million in state bonds shown for preliminary engineering and initial construction in the approved Fiscal Year 2015-2018 State Transportation

⁵ Public-private partnerships are contractual agreements formed between a public agency and a private sector entity that allow for greater private sector participation in the delivery and financing of transportation projects. This delivery method can bring creativity, efficiency, and financial capital to address complex transportation problems facing state and local governments but requires careful assessment of risks and long-term management of the resource.

⁶ <http://www.fhwa.dot.gov/construction/cqit/cm.cfm>

Improvement Program (STIP). These funds will be used both for preliminary engineering and for actual construction.

At present there is a gap between the identified funding and the range for the total project cost (\$240 million for the preferred alternative). Since maintaining this connection is critical to the state of Minnesota it is likely that the funding gap may be addressed through legislation in the upcoming 2015 legislative session beginning January 6, 2015. Without legislative action the funding gap would be addressed through major changes to the existing program, resulting in MnDOT's failure to meet performance outcomes identified in the Minnesota State Highway Investment Plan (MnSHIP),⁷ or accepting the No Build Alternative for this project.

The gap between the funding dedicated to the project as programmed in the current STIP and what it would take to build the preferred alternative would have to be programmed in an approved STIP before the lead federal agency (FHWA) could issue a Record of Decision for this project.

⁷ Available at <http://www.dot.state.mn.us/planning/mnship/pdf/mnship-full-doc.pdf>